

10 NOV 2004

Applicant: Nokia Corporation  
Application number: PCT/IB2003/006124  
Date:

November 3. 2004

### Claims

- 5 1. Method for decreasing a transmission delay in a multi-sub-channel data transmission of physical layer frames using hybrid automated repeat request with acknowledgement signaling, wherein said method comprises:  
determining, if no physical layer frame needs to be transmitted in a provided sub-channel,  
determining, if there is a physical layer frame of another sub-channel with pending acknowledgement,  
selecting said physical layer frame with pending acknowledgement, if no physical layer frame needs to be transmitted in the provided sub-channel, and  
transmitting said selected frame in said provided sub-channel.
- 10 15 2. Method according to claim 1, further comprising:  
determining, if there are physical layer frames with pending acknowledgement that have been previously selected, and selecting another physical layer frame with pending acknowledgement that has not been previously selected.
- 20 25 3. Method according to claim 1 or 2, wherein said physical layer frame with pending acknowledgement, is selected, wherein said pending acknowledgement is pending for a longer time period than the acknowledgement any of the other frames.  
4. Method according to anyone of the preceding claims, wherein said physical layer frame with pending acknowledgement is selected, wherein said pending acknowledgement is pending for a shorter time period than the acknowledgement of any of the other frames.
- 30 5. Method according to anyone of the preceding claims, wherein said physical layer frame with pending acknowledgement, is randomly selected.
- 35 6. Method according to anyone of the preceding claims, further characterized by:  
determining a threshold number, based on the number of sub-channels in said multi-sub-channel data transmission,  
determining the number of physical layer frames to be transmitted in all sub-channels,  
and

controlling the transmission power of the transmission of the physical layer frames, on the basis of the relationship between said threshold number and said determined number of physical layer frame.

- 5 7. Method according to claim 6, wherein said controlling of the transmission power comprises: increasing the transmission power for the transmission of the physical layer frames, if said threshold number exceeds said determined number of physical layer frames to be transmitted.
- 10 8. Method according to claim 6 or 7, further comprising determining an error rate, and wherein said determining of said threshold number, is also based on said determined error rate.
9. Method according to claim 8, wherein said controlling of said transmission power, is also related to said determined error rate.
- 15 10. Method according to anyone of claims 6 to 9, wherein said controlling of the transmission power comprises:  
decreasing the transmission power, if said determined number of physical layer frames to be transmitted exceeds said threshold number.
- 20 11. Method according to anyone of the preceding claims, wherein said multi-sub-channel data transmission is an uplink of a dedicated transport channel in universal terrestrial radio access.
- 25 12. Computer program product comprising program code means stored on a computer readable medium for carrying out the method of anyone of claims 1 to 11 when said program product is run on a computer or network device.
- 30 13. Computer program product comprising program code, downloadable from a server for carrying out the method of anyone of claims 1 to 11 when said program product is run on a computer or network device.
- 35 14. Wireless communication network device capable of decreased transmission delay in a multi-sub-channel data transmission of physical layer frames using hybrid automated repeat request with acknowledgement signaling, wherein said network device comprises:  
a processing unit,  
a storage, connected to said processing unit,  
a radio interface for said multi-sub-channel data transmission of physical layer frames

10 NOV 2004

3 33

using hybrid automated repeat request, wherein said radio interface is connected to said processing unit and to said storage, and wherein said radio interface comprises a transmitter and a receiver,

characterized by

- 5            a first component for determining, if no physical layer frame needs to be transmitted in a provided sub-channel,
- 10          a second component for determining, if there is a physical layer frame of another sub-channel with pending acknowledgement,
- 15          a third component for selecting, said physical layer frame with pending acknowledgement, if no physical layer frame needs to be transmitted in the provided sub-channel, and
- a fourth component for transmitting said selected frame in said provided sub-channel, wherein said first component said second component said third component and said fourth component are each connected to said radio interface, and wherein said first component is connected to said second component, said second component is connected to said third component, and said third component is connected to said fourth component.

15. Wireless communication network device according to claim 14, further characterized by

- 20          a component for determining a threshold number, based on the number of sub-channels in said multi-sub-channel data transmission, wherein said component for determining said threshold number is connected to said radio interface;
- 25          a component for determining the number of physical layer frames to be transmitted in all sub-channels, wherein said component for determining said number of physical layer frames is connected to said radio interface, and
- a component for controlling the transmission power of said transmitter for the transmission of the physical layer frames, in dependence of the relationship between said threshold number and said determined number of physical layer frames, wherein said component for controlling is connected to both of said components for determining and to said radio interface.

30

16. Wireless communication network device according to anyone of claims 14 or 15, characterized in that said network device is a mobile user terminal device.